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RAraghavarora

Raghav Arora

Education

2017–2022 **B.E. (Hons.) - Electrical and Electronics Engineering + MSc.(Hons.) Chemistry**, *Birla Institute of Technology and Science*, Pilani, *(CGPA: 8.86)*.

2017 **CBSE (Class XII)** , *KV ONGC*, Dehradun, *(Percentage: 88%)*.

2015 **ICSE (Class X)** , *St. Thomas' College*, Dehradun, *(Percentage: 91.6%)*.

Technical Skills

- Areas of interest: Robotics, Computer Vision, Reinforcement Learning
- Proficient in: Python, PyTorch, Keras, C++, MATLAB, Git, Unix, Habitat, AI2THOR
- Familiar With: Verilog, Javascript, Blockchain, LTSpice, Arduino, Java, AmberMD

Research Projects

Object Rearrangement using Embodied AI (ongoing)
Guide: Prof. K Madhava Krishna

- An agent is trained for rearranging various misplaced objects in a room.
- Use of Commonsense Reasoning based on Large Language Models(LLM) to automatically detect misplaced objects in a room and rearrange them to their correct position.
- Using Mask2Former, object instances are recognized and mapped to object embeddings generated by CLIP.
- Construct a continuous scene representation from RGB images as the agent explores the scene. Object relational embeddings are learnt and updated on the fly.

Deep learning for quantum chemistry using Density Functional Tight-Binding Method
Guide: Prof. Alexandre Tkatchenko

- Development of novel molecular descriptors to mathematically encode molecules in a way that can be input to neural networks.
- Existing geometric descriptors are combined with electronic properties obtained from semi-empirical quantum-chemistry methods to generate appropriate molecular representation.
- Deep Learning architectures are designed for using the molecular descriptors for predicting different physico-chemical properties.
- Prediction of properties is of crucial importance for drug discovery, and this project specifically aims at Transferability and Scalability of ML models.

Investigation of image mosaicing techniques for UAV navigation
Guide: Prof. Meetha V. Shenoy

- Project started with the literature review of existing image mosaicing techniques for navigation of unmanned aerial vehicles, followed by the performance comparison of the algorithms.
- These algorithms use aerial images captured in real-time from different cameras, and perform seamless stitching to produce a wider field of view.
- The new image hence generated can be used for the navigation of other Unmanned Aerial Vehicles.

Real-Time Single Image and Video Super-Resolution
Guide: Dr. Surekha Bhanot

- For conversion of Low Resolution Images to High Resolution, traditional approaches make use of interpolation to upscale the image in the 1st step, which makes the entire process computationally extensive.
- This project makes use of an efficient sub-pixel convolutional layer, which is the last layer of the CNN for upscaling the image. Hence, the process becomes computationally fast, and can be used for real-time applications.

Molecular Dynamics Simulations for Room Temperature Ionic Liquids
Guide: Prof. Prashant U. Manohar

- Laboratory oriented project to simulate acetonitrile in the presence of room-temperature ionic liquids using Amber MD software, and present alternatives to traditional organic solvents.
- Multiple physical and chemical properties of ionic liquid [bmim][BF4] were analysed in the presence of acetonitrile to obtain their relative stability and the possibility of using RTILs as solvents was studied.

Learning Projects

CityLearn-2022
: A part of NeurIPS 2022 Competition, this challenge uses Reinforcement Learning to to coordinate the energy consumed by a list of buildings within a simulated micro-grid.

E-Wallet
: Development RESTful APIs used by college students to make payments using the college app. It was used during college fest with a total participation of 4000 participants generating sales worth $30,000 in five days. Major drawback invovled a bug in the E-Wallet: race conditions. It took months of reading and rewriting the code to fix the bug, and ultimately, I made use of celery to make the firebase calls asynchronous to solve the problem.

Project Erlebnisse
: Built an e-voting application using Ethereum Blockchain protocol and deployed it on Microsoft Azure, as a part of Microsoft Codefundopp. Gained expertise in blockchain, hashing algorithms and other security protocols. Hands-on experience with Solidity, blockchain technology internals, expertise on smart contracts.

Integrated Reports Management and Decision Support System
: Built a system to generate customised reports and make a knowledge base using Information Retrieval technique for making necessary predictions using the library database at the Scientific Information and Resource Division (SIRD), IGCAR. The Decision Support System was developed through hypothesis testing around the library database using the Koha Library Management System.

Relevant Courses

Computer Science
: Neural Networks and Fuzzy Logic, Digital Image Processing, Applied Calculus, Linear Algebra, Probability and Statistics, Differential Equations, Optimization Techniques, Digital Design, Microprocessors and Interfacing

Electrical and Electronics
: Control Systems, Electronic Devices, Electrical Machines, Microelectronic Circuits, Analog and Digital VLSI Design, Communication Systems, Analog Electronics, Power Electronics, Power Systems

MOOCs
: Introduction to Algorithms and Analysis, Learning from Data, Introduction to Programming with MATLAB